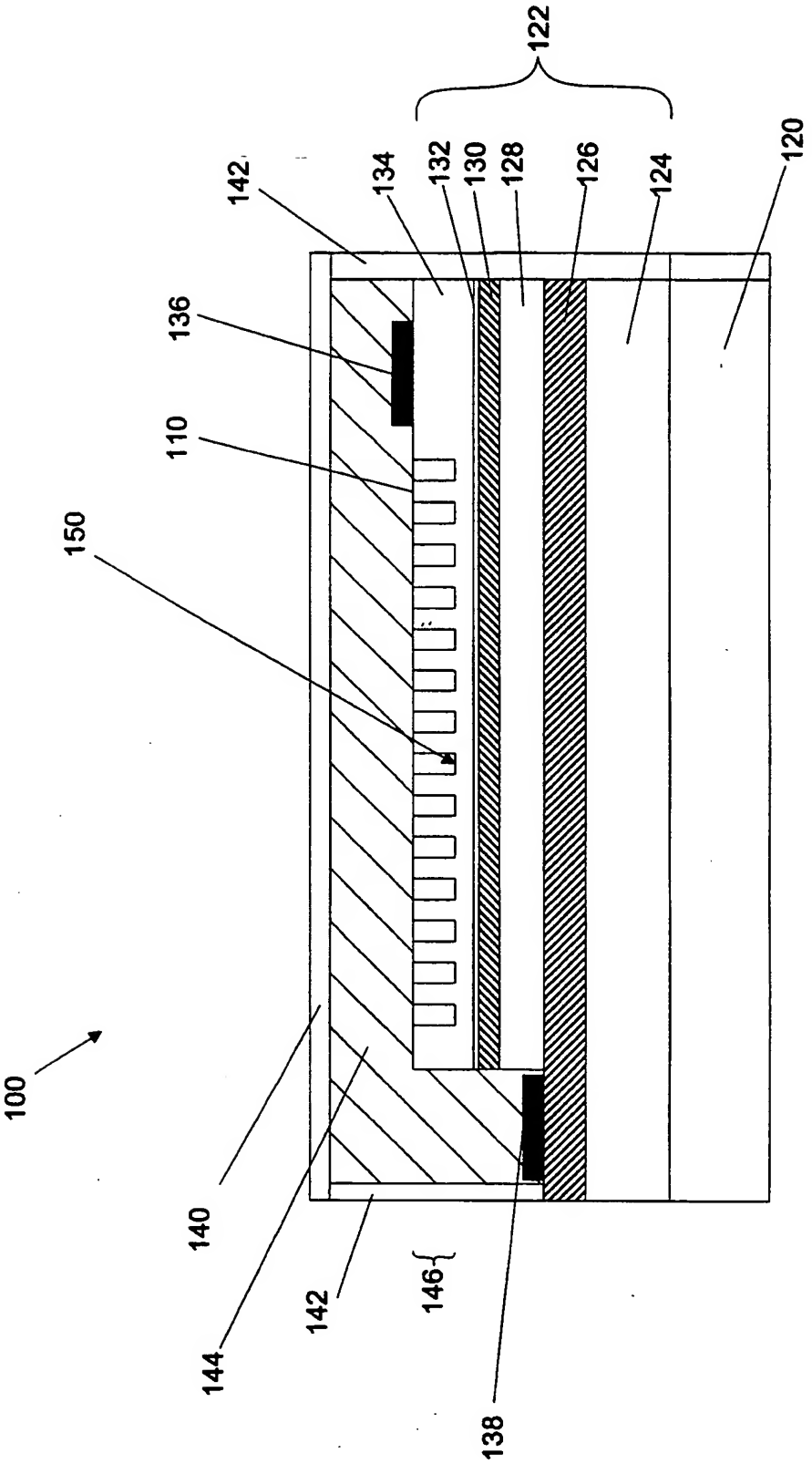

122
120
142
134
132
130
128
126
124
136
110
150
100
140
142
146
144
138

FIG. 1

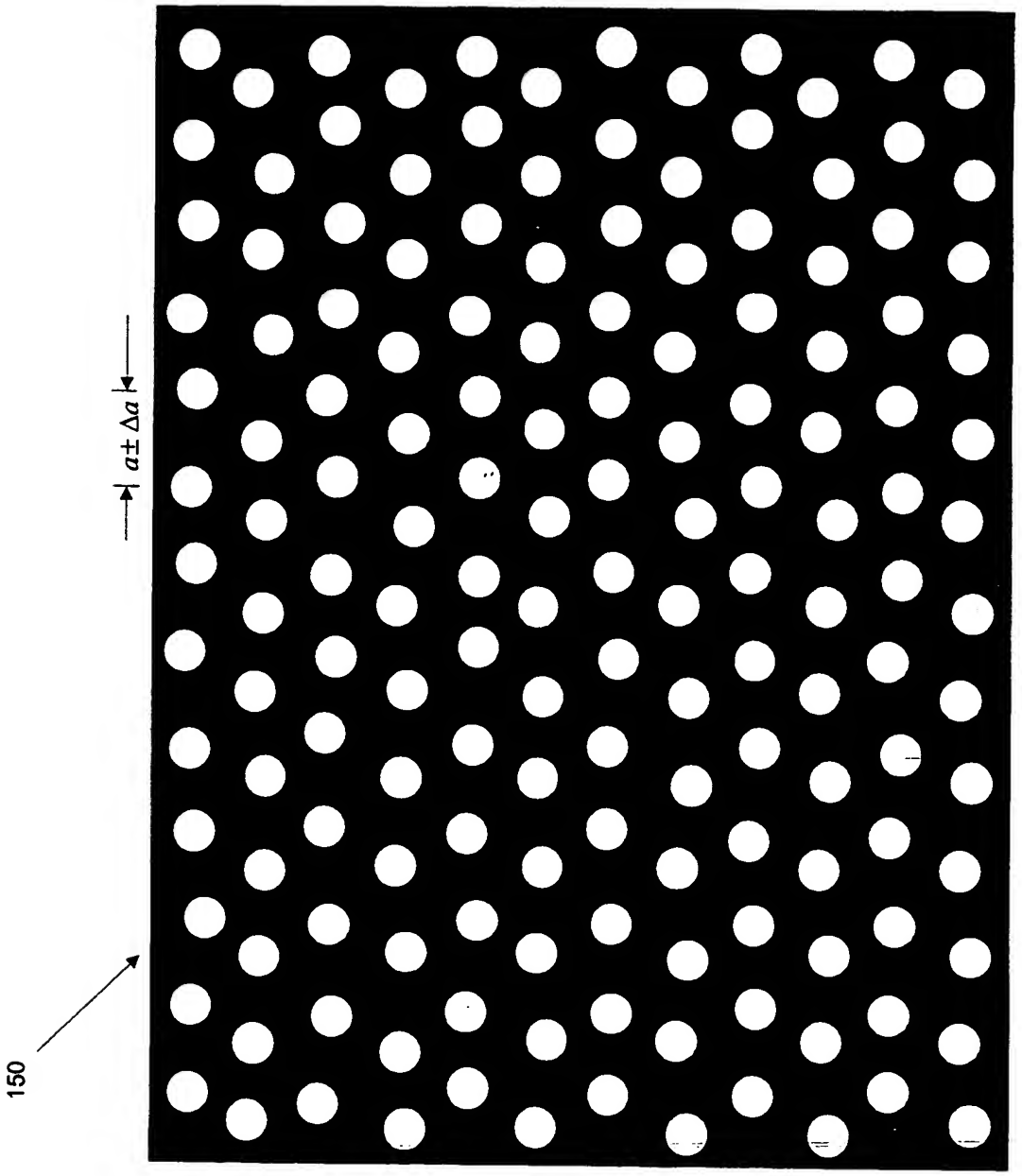


FIG. 2

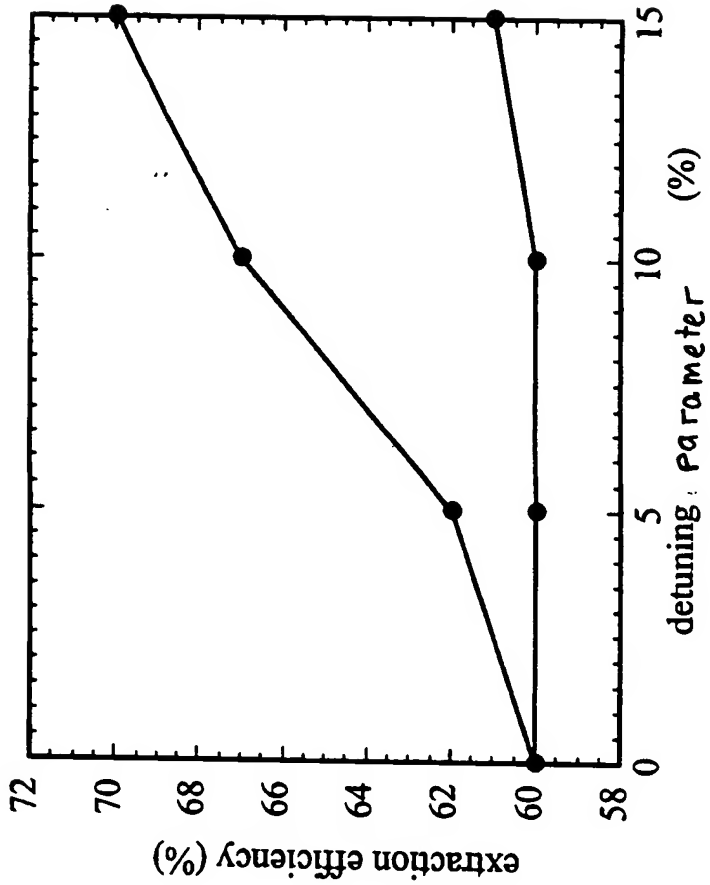

extraction efficiency (%)
72
70
68
66
64
62
60
58
0
5
10
15
detuning parameter (%)

FIG. 3

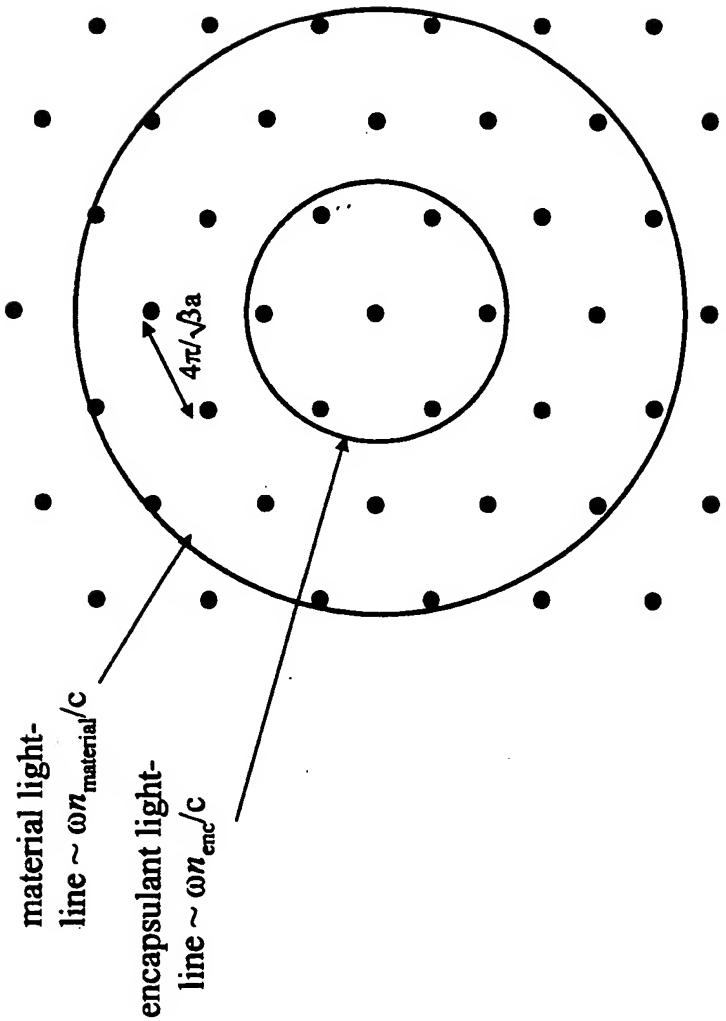
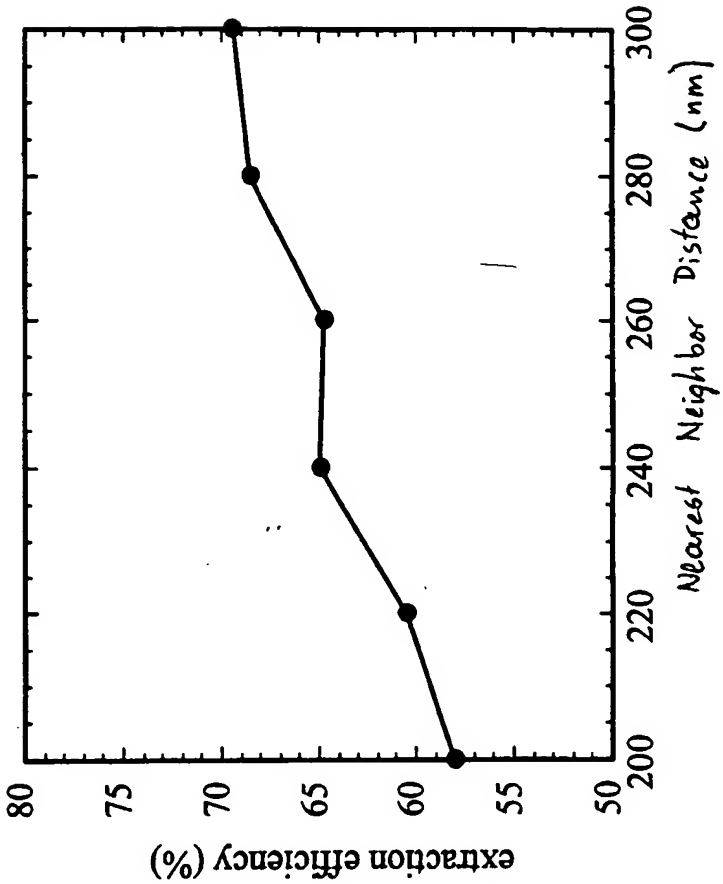

material light-line ~ $\omega n_{material}/c$
encapsulant light-line ~ $\omega n_{enc}/c$
$4\pi/\sqrt{3}a$

FIG. 4

FIG. 5


extraction efficiency (%)
80
75
70
65
60
55
50
200
220
240
260
280
300
Nearest Neighbor Distance (nm)

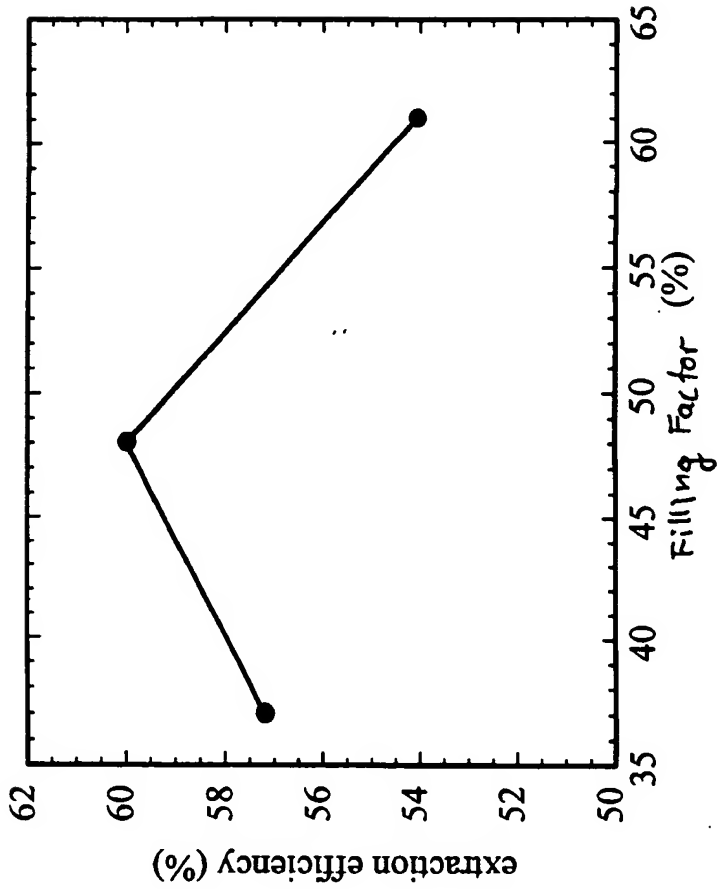

extraction efficiency (%)
62
60
58
56
54
52
50
35
40
45
50
55
60
65
Filling Factor (%)

Figure 6

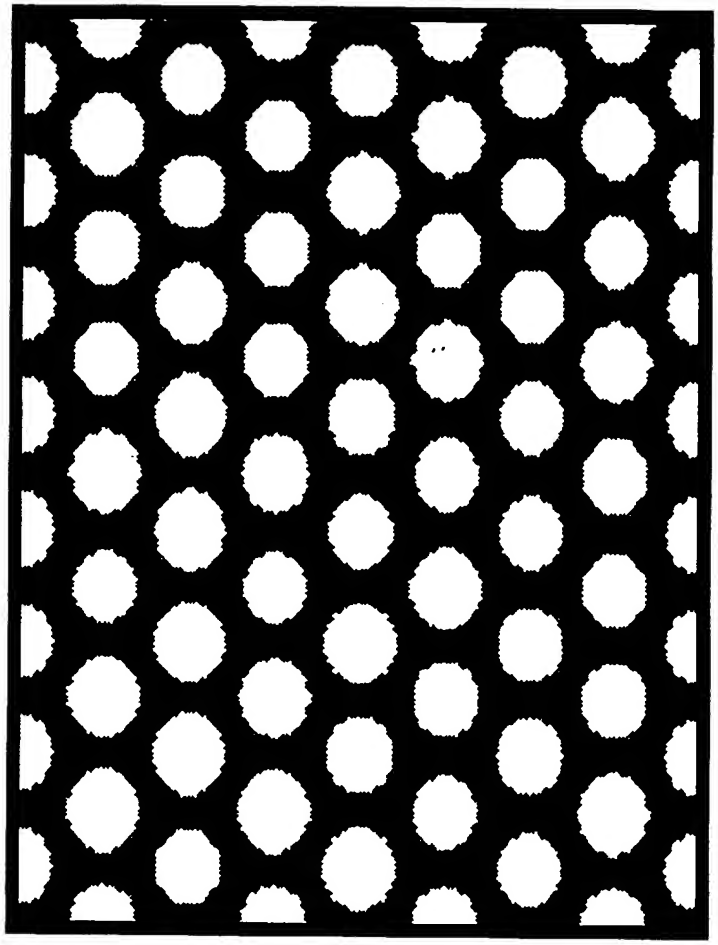


FIG. 7

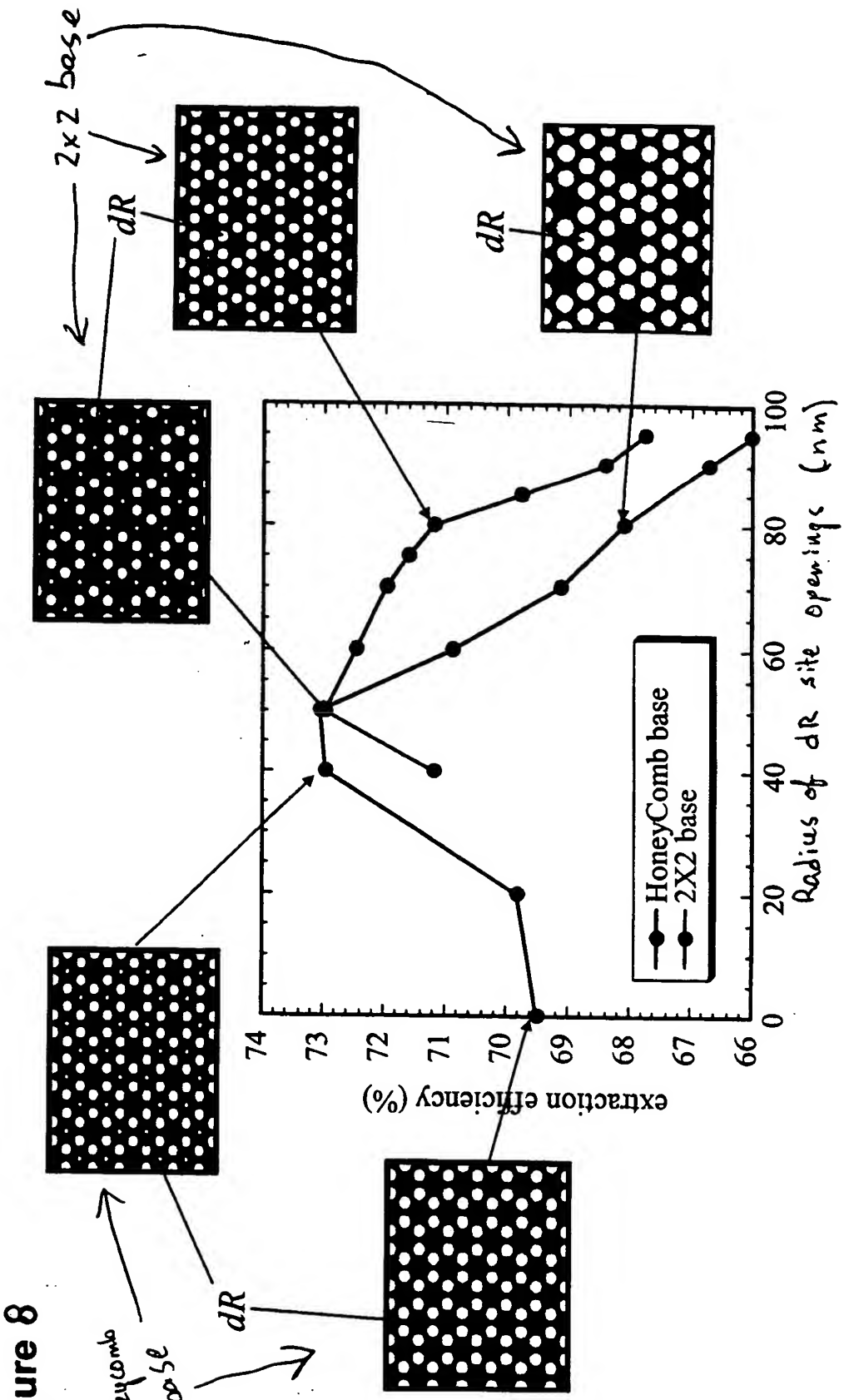
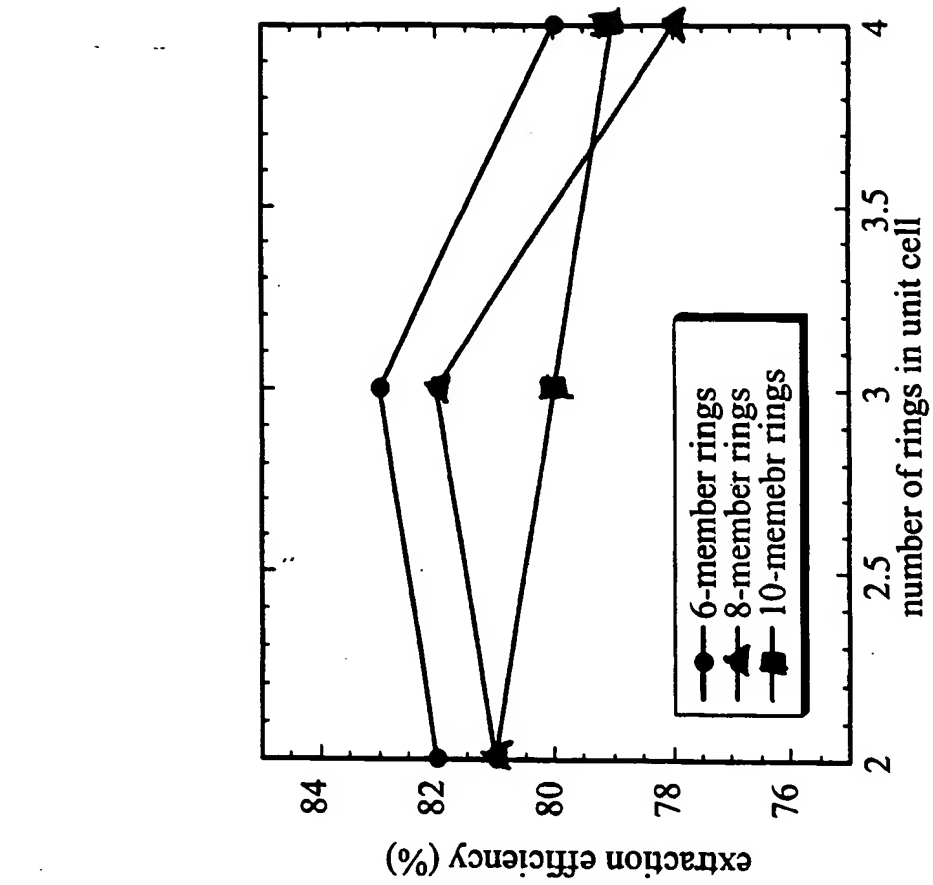

2x2 base
dR
dR
dR
dR
HoneyComb base
2X2 base
extraction efficiency (%)
Radius of dR site openings (nm)
74
73
72
71
70
69
68
67
66
0
20
40
60
80
100

Figure 8


extraction efficiency (%)
84
82
80
78
76
2
2.5
3
3.5
4
number of rings in unit cell
6-member rings
8-member rings
10-memebr rings

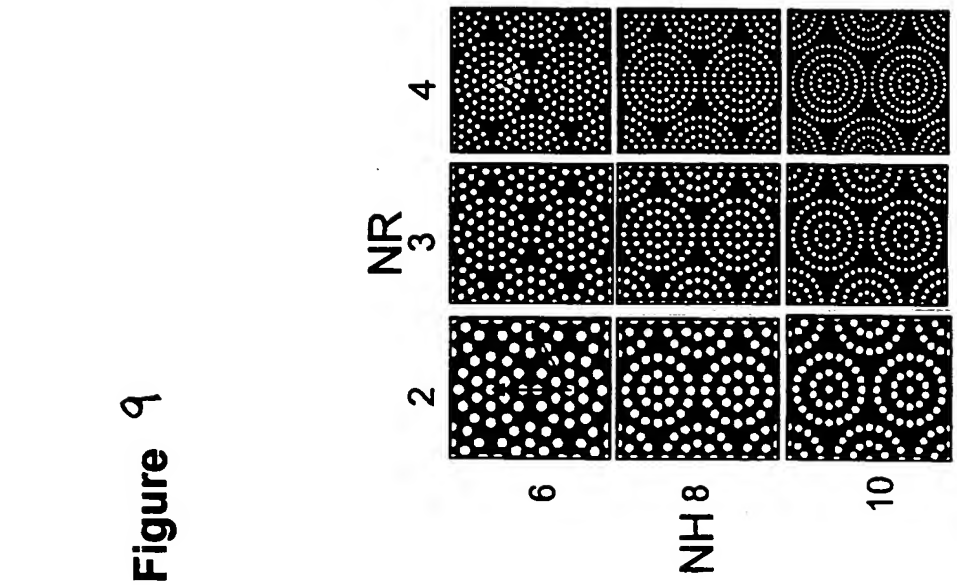

NR
2
3
4
NH
6
8
10

Figure 9

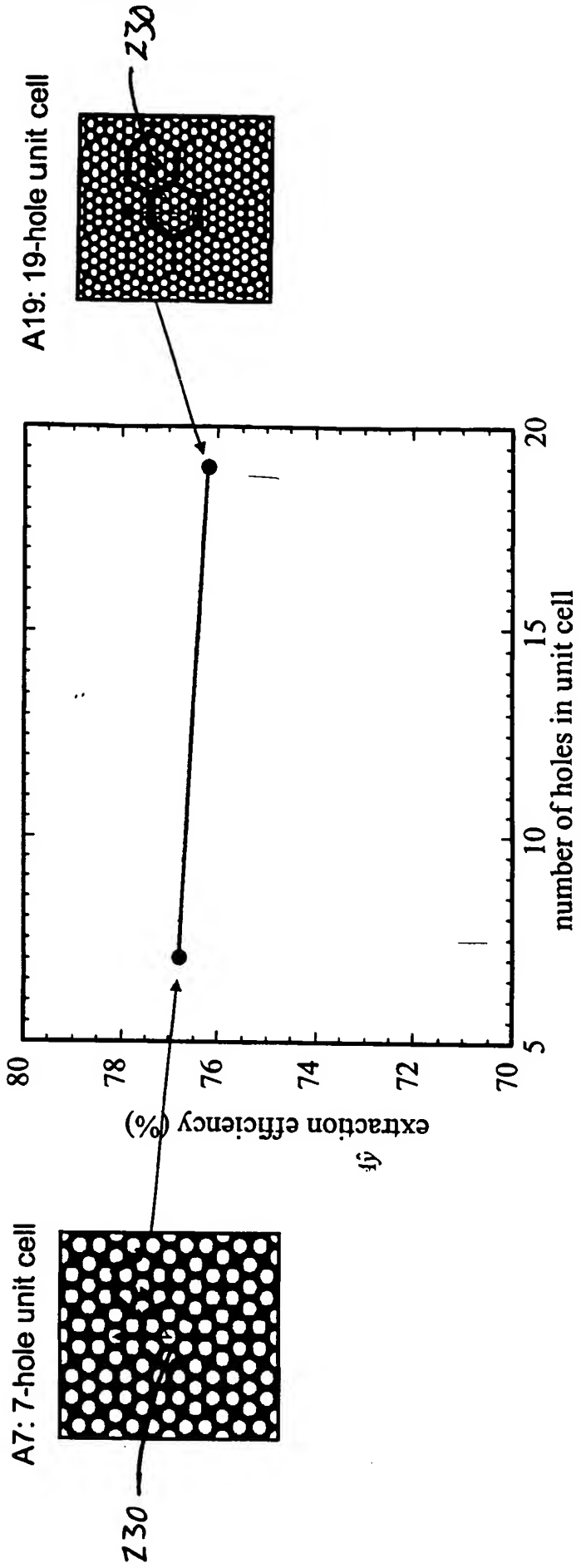

230
A19: 19-hole unit cell
80
78
76
74
72
70
extraction efficiency (%)
5
10
15
20
number of holes in unit cell
A7: 7-hole unit cell
230

Figure 10

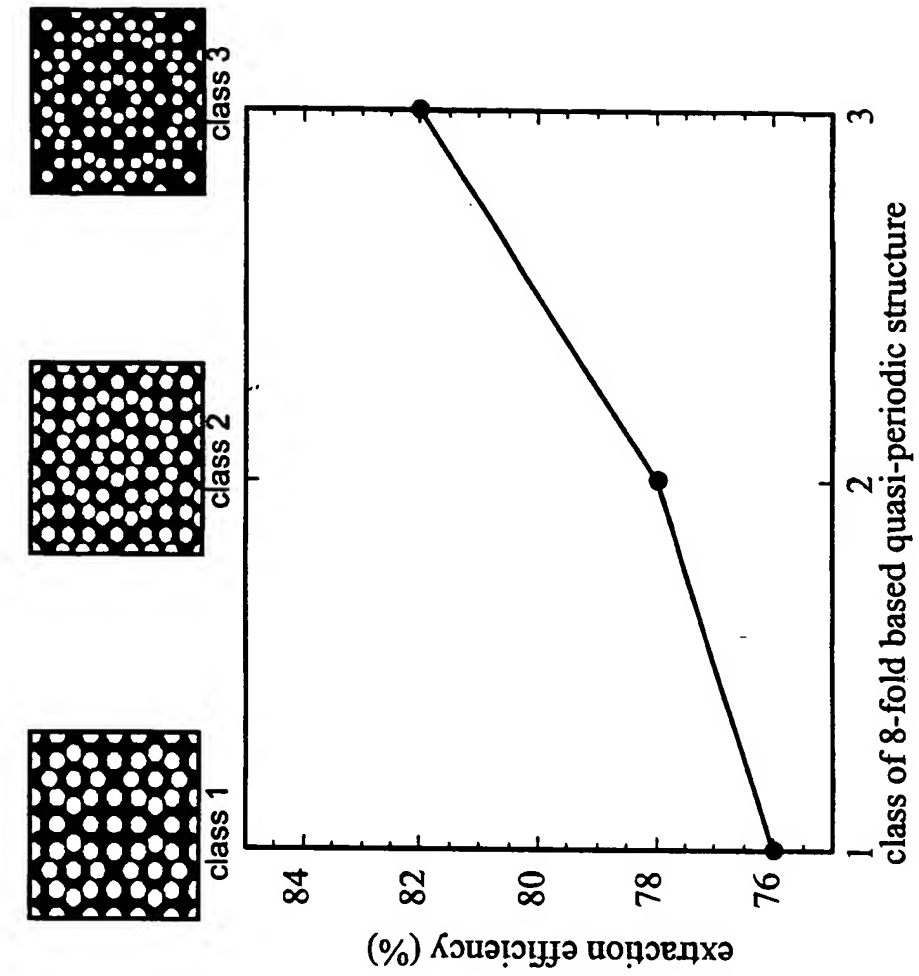

class 3
class 2
class 1
84
82
80
78
76
extraction efficiency (%)
1
2
3
class of 8-fold based quasi-periodic structure

Figure 11

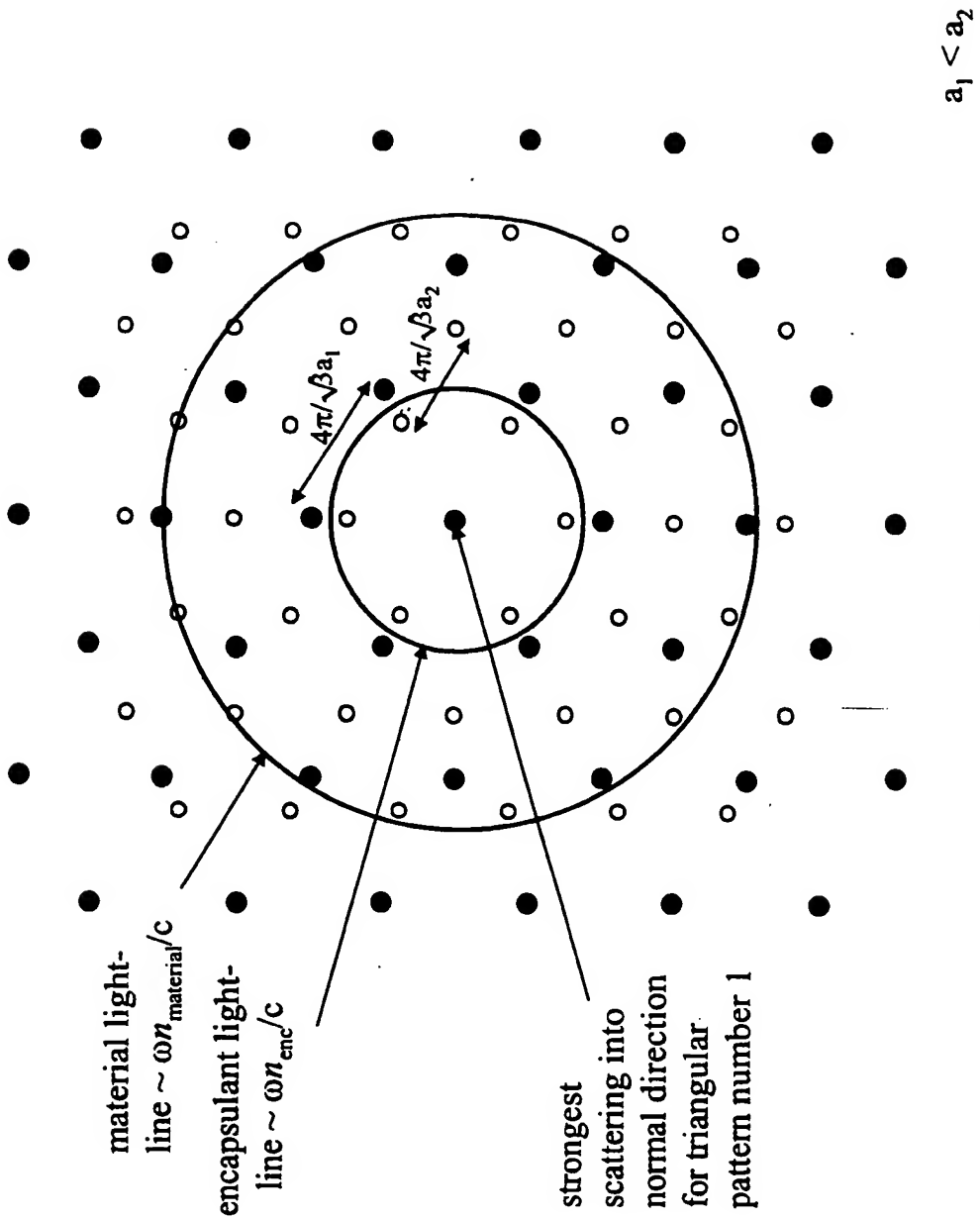

$a_1 < a_2$
$4\pi/\sqrt{3}a_1$
$4\pi/\sqrt{3}a_2$
material light-line ~ $\omega n_{material}/c$
encapsulant light-line ~ $\omega n_{enc}/c$
strongest scattering into normal direction for triangular pattern number 1

Fig. 12

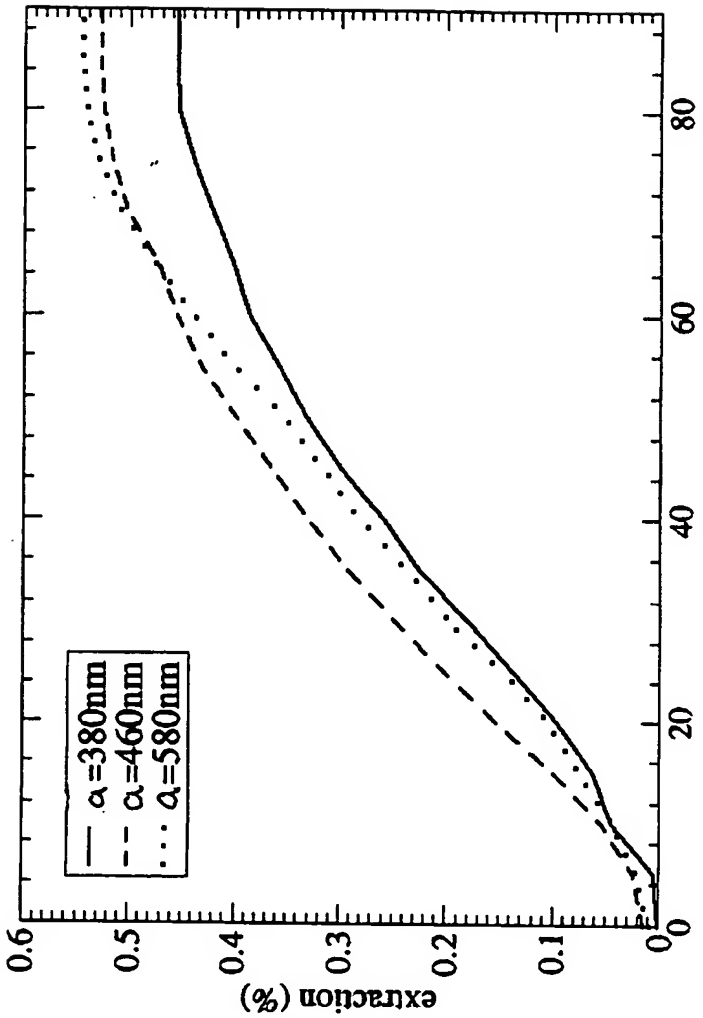

extraction (%)
0.6
0.5
0.4
0.3
0.2
0.1
0
0
20
40
60
80
α=380nm
α=460nm
α=580nm

FIG. 13

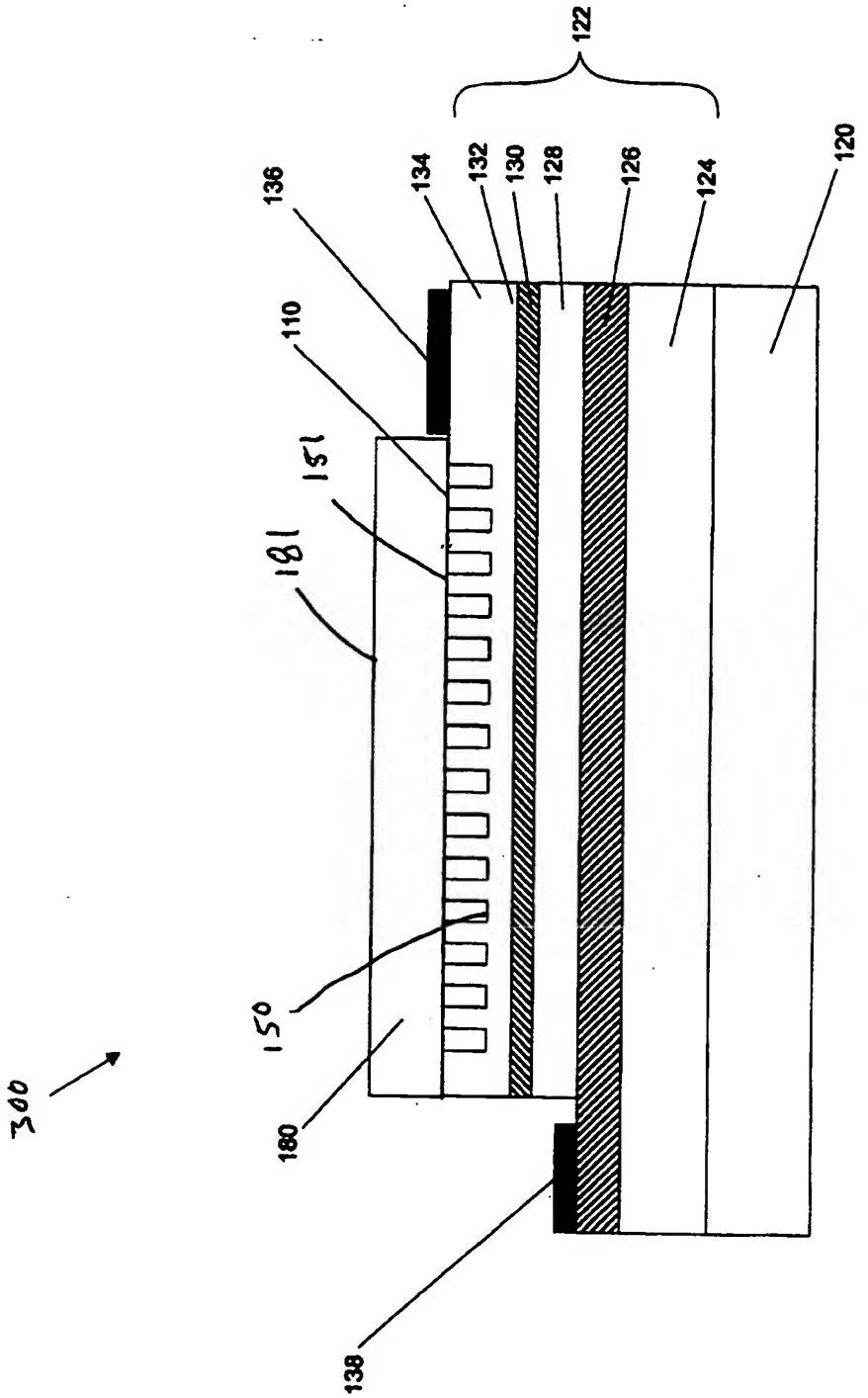


FIG. 14

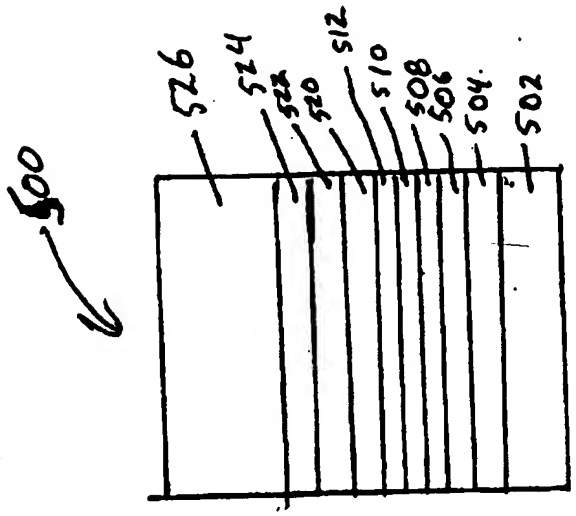

500
526
524
522
520
512
510
508
506
504
502

FIG. 16

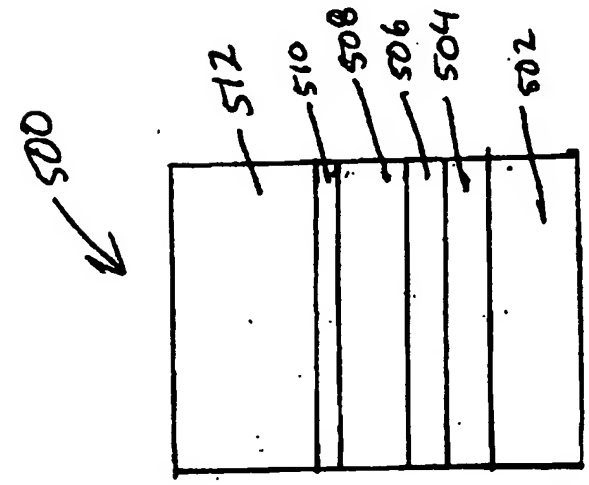

500
512
510
508
506
504
502

FIG. 15

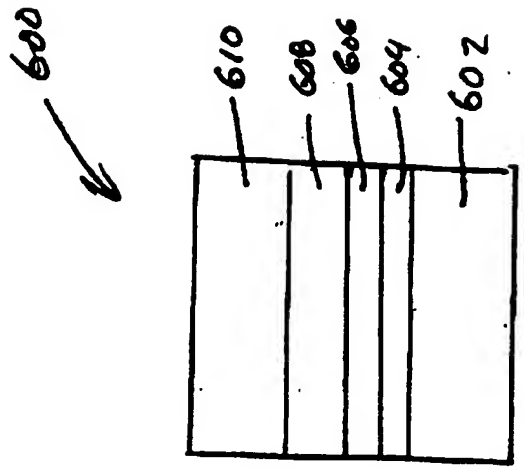


FIG 17

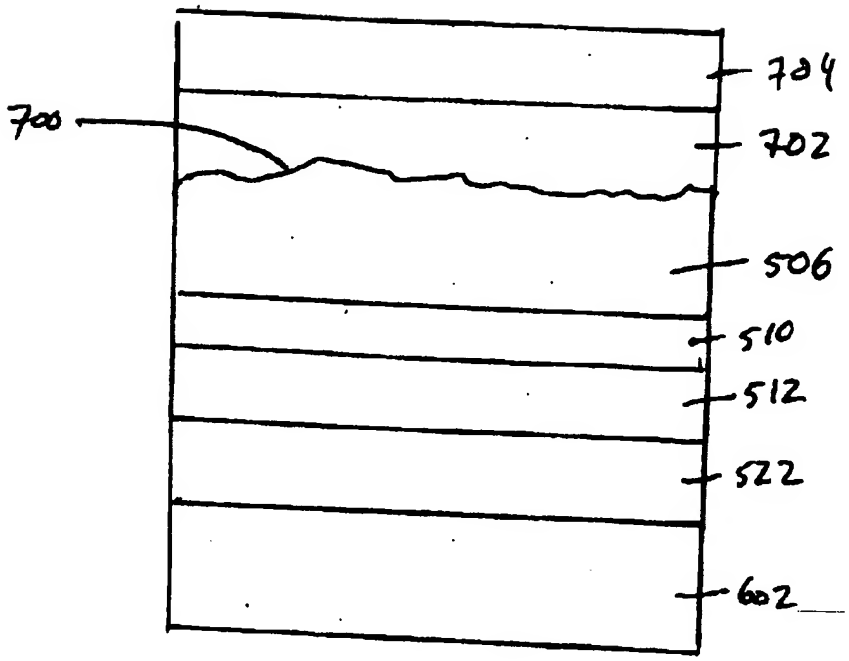


FIG. 18

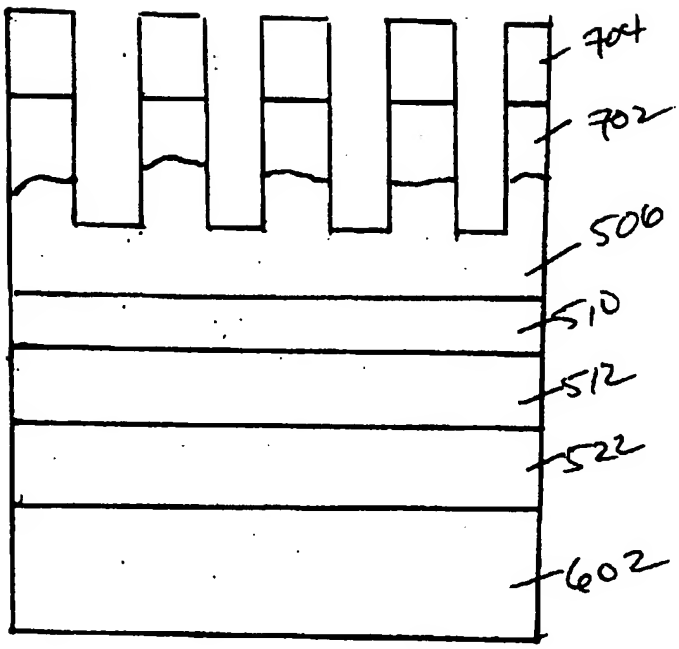


FIG. 19